The Optimal Time to Dunk an Oreo, According to Science

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Have you submerged an Oreo into a glass of milk and lingered too long? Did you watch in horror as America's supposedly favorite cookie disintegrated before your very eyes? Fear no more! Here's how to find (and elongate) your optimal dunk time.

THE SHORT ANSWER

Dip your cookie for three seconds, give or take. Carry on with your life, dear reader.

THE LONG ANSWER

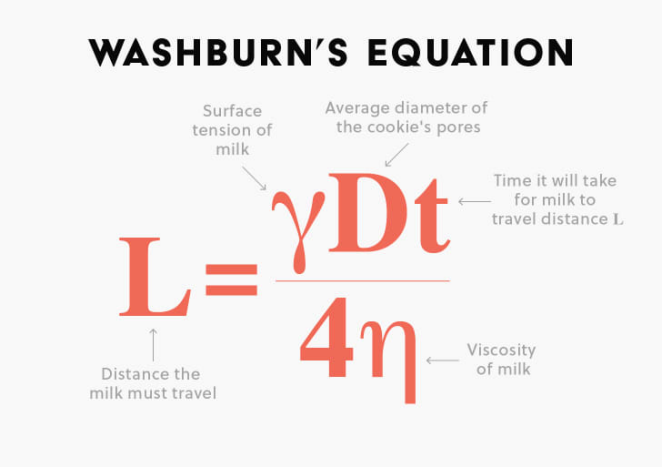
Well, it depends. Do you prefer a crispy cookie masked in a thin veneer of milk? A cookie that has metamorphosed into unrecognizable gloop? Do you believe in a Goldilocks zone, a Platonic middle-ground that's neither too dry, nor too spongy, but *just right*? It's all subjective. But let's assume you want an Oreo that is pleasantly soggy and has maintained its structural dignity.

There's math for that. In the late 1990s, Len Fisher, then a professor of physics at the University of Bristol, sparked a media storm when he argued that a decades-old mathematical formula could predict the perfect dunk time for a cookie. It's all thanks, he claimed, to capillary action.

Water molecules are adhesive: They cling to solid surfaces. (It's why water in a beaker shows a meniscus—it's attracted to the sides of the container.) When water enters a small tube, the liquid can adhere to surfaces in ways that seem to defy gravity: This is

why water may crawl up your drink's straw and why a paintbrush seems to slurp up liquid. That's capillary action in a nutshell.

On a microscale, a cookie is essentially a series of small, starchy tubes. Fisher writes in his book *How to Dunk a Doughnut* that a dunking liquid (in our case, milk) is "held in place in the porous matrix by the pressure across the meniscus in the smallest of pores." In other words, capillary action helps the milk spread through the cookie. In the early 20th century, the American scientist E.W. Washburn cooked up a formula to describe this watery journey.



LUCY QUINTANILLA

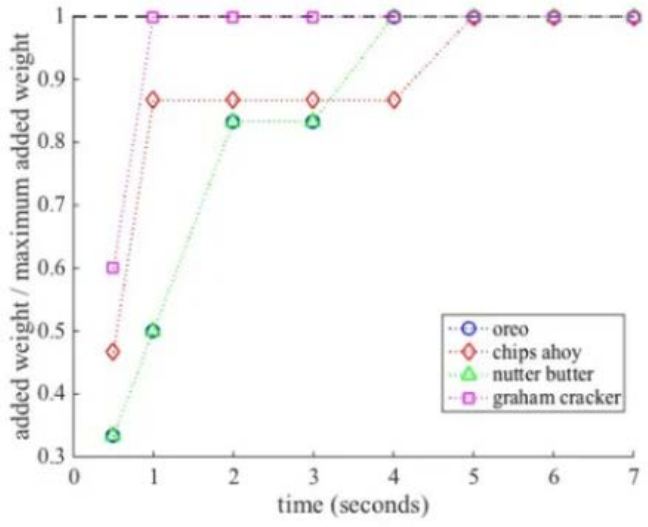
Washburn tested and confirmed his formula by observing ink blots spread through paper. (A simplified version of his equation explains how inkjet printers spit out dry, sharp-looking text.) But it took nearly a century for someone such as Fisher to apply the formula to baked goods: After finding reliable numbers for the variables, Fisher rearranged the equation and solved for T (time).

He discovered that the perfect dipping time for a typical British dunking biscuit with a conventional dip was three-and-a-half to five seconds.

But Fisher never tested Oreos. So in 2016, members of Utah State University's Splash Lab—an academic group studying the behaviors of fluids—put Oreos to the test. (Splash Lab, we should note, has an appetite for quirky experiments: They've studied the fluid dynamics of urinal splashback, analyzed the physics of the perfect skipping stone, and even tested the insulating properties of beards.)

Three researchers gathered Oreos, Chips Ahoy, Nutter Butter, and Graham Crackers and dipped the cookies halfway in 2 percent milk for half a second to seven seconds. After dunking, the team weighed the treats and measured how much milk had been absorbed.

The results: Oreos absorbed 50 percent of their potential liquid weight in just one second. After two seconds, they absorbed 80 percent. The number flatlined briefly for a second. After the fourth second, the cookie maxed out: It absorbed all its possible milk. "This data indicates that for the tested cookies, keeping your cookie in the glass any longer than five seconds does not lead to any additional milk entering the cookies," their study suggested.



Oreo cookies absorbed milk at the same rate as Nutter Butter, taking in 100 percent of their liquid weight in four seconds.
SPLASH LAB

Splash Lab then performed a second test, dunking all cookies for six seconds and attaching them horizontally to a clamp. They waited for the cookies to collapse. The Oreo lasted an impressive five minutes! Compare that to measly Graham Crackers, which crumbled after eight seconds.

The takeaway: Three seconds is enough time to saturate most of an Oreo. There's no benefit to dunking longer than four seconds. (Unless you want to watch the cookie crumble into your milk. As Splash Lab's Randy Hurd, a mechanical engineering Ph.D. candidate, told us: "Waiting for the crisp cookie structure to break down is not necessarily a waste of time if that's what you prefer." We don't judge.)

However, things get more complicated if you choose a different kind of dairy.

THE LONGER ANSWER

Your choice of milk could change the optimal dunk time by a few split seconds.

In 2011, researchers published a study in the *Journal of Food Science* that explained why milk doesn't immediately turn breakfast cereal into mush: Fats and other solids in the dairy hindered "liquid infiltration," slowing absorption. The same process is true of cookies, says Jennifer Fideler, a graduate student in food science at North Carolina State University.

Milk, for one, is full of sugars. Sugars are *hygroscopic*, meaning they hold onto moisture and can prevent liquid from seeping into the cookie. Additionally, fat and carbohydrate molecules are big. They can prevent the water in the milk from infiltrating the cookie's porous matrix. "Not only is it likely that the fat content of the milk (whole, 2 percent, skim, even heavy whip!) would affect the rate of moisture migration ... but the fat

included in the cookie—and even moreso the cream filling—would help resist the influx of fluid," Fideler wrote in an email.

Fat content doesn't just slow down absorption time. It's also known to enhance the flavor. In 1999, Len Fisher tested more than 200 British biscuit and drink combinations and concluded that milk could make a cookie 11 times more flavorful. (This wasn't peer-reviewed, *and* it was sponsored by a biscuit company, so take it for what it's worth.) "Milk is essentially fat droplets suspended in water and those fat droplets stay around in your mouth and they hang on to the flavour in the biscuit so that the aroma can be released up to the back of your nose," Fisher told the BBC.

So, if you're the type of person who dreams of extending the optimal Oreo dunk time while enhancing the flavor, toss the skim milk down the drain and pour a cup of high-fat dairy. Whole milk (3.25 percent butterfat) spiked with half-and-half (generally 10 percent butterfat) could extend your dunk time. But if you wanted to indulge and throw a Hail Mary—and have a few spare notches left in your belt—try dunking in heavy cream (36 percent butterfat). Heck, while we're at it, why not go all the way and dip it in melted butter (80 percent butterfat).

(We'd like to take this moment to say we are not licensed to give nutritional advice and are not liable for culinary crimes against humanity. So maybe don't do this.)

THE MUCH LONGER ANSWER

If you wanted to boost the optimal Oreo dunk time even longer, there's another principle you can hack: *Water Activity*.

Water activity is a measurement of how likely something gives away moisture. It's measured on a scale from 0 to 1: Milk, for example, possesses a high water activity of *0.98*. It readily gives its water away. A cookie, on the other hand, has a water activity hovering around *0.3.* It holds onto its moisture and is more likely to absorb water.

Food manufacturers and processors have to constantly contend with water activity. It's critical in determining a product's safety, stability, and shelf life: Controlling water activity is the easiest way to prevent—and predict—the spread of dangerous bacteria [PDF]. (That's because items with a high water activity are more likely to give water away to nasty microorganisms, causing spoilage.)

But for our selfishly sweet-toothed purposes today, water activity is just another factor affecting the critical cookie dipping time. A liquid with a lower water activity will hold onto its moisture more tightly than standard milk, Fideler explains. So, if you wanted to extend the optimal dunk time further, you should try to dip your Oreo into dairy that not only contains lots of fats and carbs, but also possesses a relatively low water activity. With that in mind, we have the perfect recommendation: Sweetened condensed milk. (We don't actually recommend this.)

Boasting a high butterfat content (8 percent), obscene loads of carbs (166 grams per cup), and a relatively low water activity (.87), sweetened condensed milk is perfect if you're the kind of person who relishes long dunk times and believes "calories" are just another government conspiracy designed to scare you from chugging modernity's decadent ambrosias.

Dunk away!

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